RDT

Brief

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A 2-D MASW Shear-Wave Velocity Profile Along A Test Segment of Interstate I-70, St. Louis, Missouri

Research Development and Technology

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Summary of Results:

Based on our study, the newly-developed multi-channel surface wave (MASW) acoustic technology is cost-effective and reliable technology for the Missouri Department of Transportation (MoDOT). It could save MoDOT significant field time and reduce current costs. The technology meets all of the test queries, as described below. MASW can also be used prior to drilling, thereby optimizing drilling efforts. The combined approach of MASW and targeted borings could also provide superior subsurface control relative to current practices, at a reduced cost. This could help minimize claims for changed site conditions, etc. MASW data can also be acquired in areas that are inaccessible to drill rigs (steep slopes, river banks, beneath bridges, near homes, etc.).

MASW technology, however, should not be used in lieu of borehole control.

Study Purpose:

MoDOT wanted to evaluate a promising new non-invasive imaging technology, MASW, in terms of its utility, cost and effectiveness against existing technologies used by MoDOT.

To undertake the evaluation an MASW shear-wave velocity profile (Figure 1) was acquired along a 6400 ft test segment of Interstate I-70 in downtown St. Louis.

Specific Study Issues and Results:

1. **Issues:** Can the MASW tool be used to accurately estimate the depth to rock? **Result:** The shear-wave velocity profile extends from the surface to depths in excess of 50 ft. The MASW-estimated depths to bedrock (Figure 1) were consistent with borehole depths to bedrock at eighteen control locations.

2. **Issue:** Can the MASW tool be used to accurately estimate the shear-wave velocity of shallow soils? **Results:** The individual MASW shear-wave velocity curves (comprising the profile) compared very well with SCPT shear-wave velocity curves at five control locations (Figure 2).

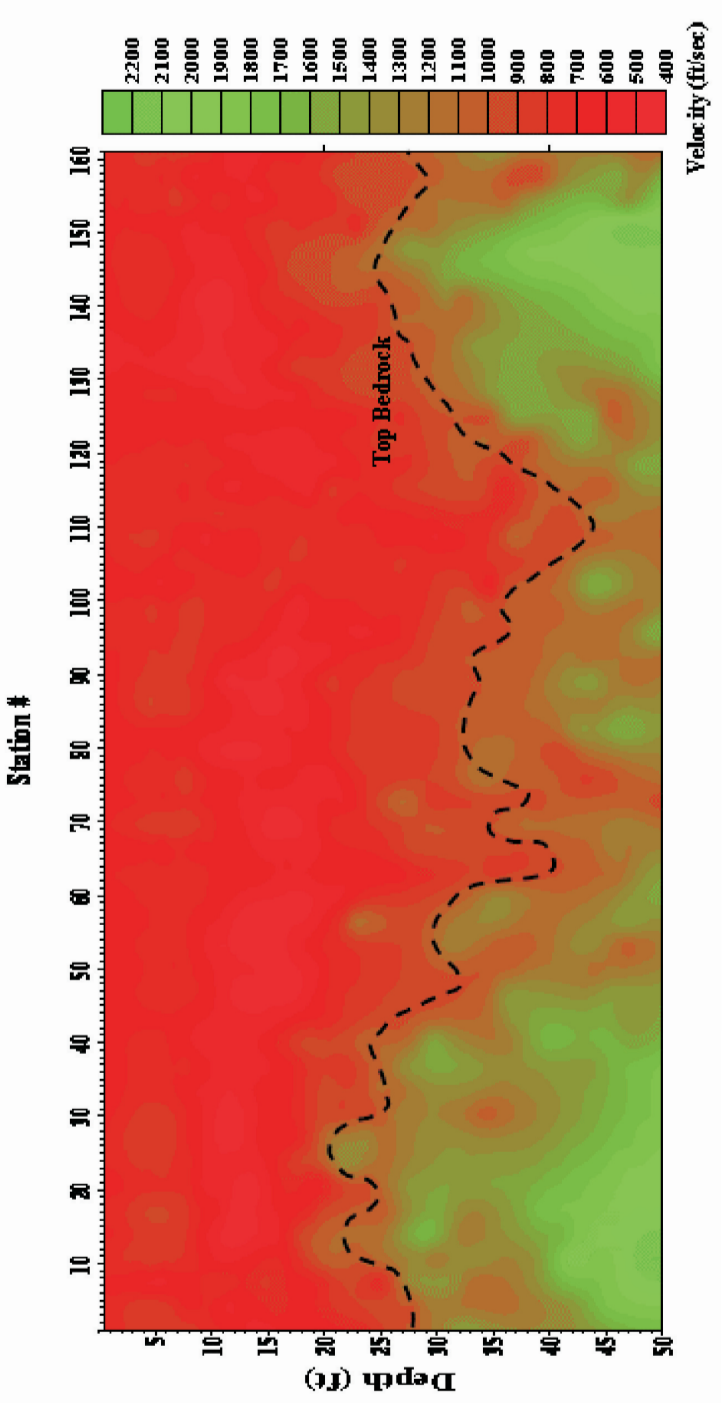

Figure 1: Interpreted MASW shear-wave velocity profile. The profile is comprised of 161 shear-wave velocity curves spaced at 40 ft intervals. The profile was truncated at a depth of 50 ft.

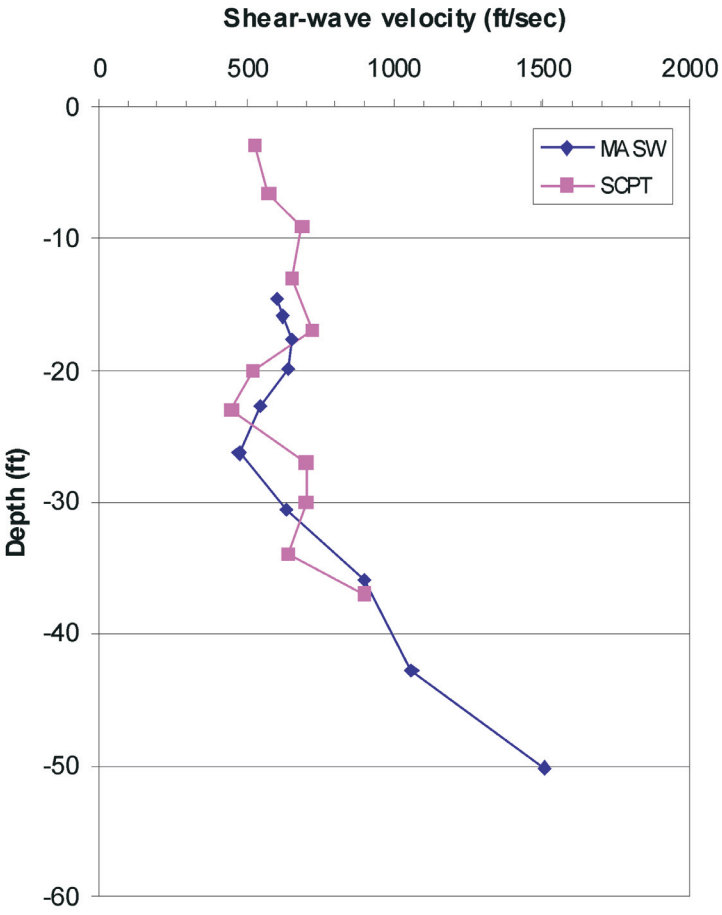

Figure 2: SCPT curve for site A6434-10 and MASW trace #140. The SCPT curve was acquired on the elevated embankment. The MASW trace was acquired on the paved roadway.

3. **Issue:** Can the MASW tool can be used in "noisy" environment? **Results:** The MASW data were acquired in the closed reversible lanes of I-70 during periods of high traffic volume indicating the acoustic tool can work well in an extremely "noisy" environment.

4. **Issue:** Can the MASW tool can be used in areas and at depths inaccessible to the SCPT tool? **Results:** The MASW data were also acquired on paved roadway (environment inaccessible to the SCPT tool) and provide velocity control to sub-bedrock levels (depths inaccessible to SCPT tool).

5. **Issue:** Is the MASW tool cost-effective relative to conventional technologies (borehole and SCPT control)? **Result:** 161 MASW shear-wave velocity curves (which collectively comprise the MASW profile) were acquired in 4 working days. It would have taken much longer and much more effort to have acquired 161 SCPT shear-wave velocity curves.

Conclusion

The MASW data acquired at the I-70 test site met or exceeded expectations in terms of these evaluation criteria. The MASW tool is a reliable and cost-effective method for estimating depths to bedrock and soil shear-wave velocities. However, the technology should not be used in lieu of borehole control. Rather it should be used to supplement borehole control, thereby reducing the overall cost of geotechnical investigation without sacrificing accuracy or reliability.

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